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ABSTRACT

Worldwide economic productivity is examined in this paper. There are seven major sections. Section 1 is an introduction which discusses how as the seventies came to a close without producing a strong and sustained recovery from global economic recession, the spotlight of public concern focused on the problem of productivity. Trends which have affected productivity are discussed and ways of measuring productivity are examined. Section 2 discusses why productivity is important. Higher productivity is a mechanism for improving the material quality of life. A rise in output per hour of work can finance increases in income, help restrain inflation, and enhance the competitiveness of products in the international market place. Structural shifts in the economy are the focus of the third section. For national economies, the major cause of higher productivity has been structural change, the wholesale movement of workers out of less productive sectors of the economy into more productive ones. The fourth section examines changing relationships among the factors of production. At the root of the current crisis in labor productivity is an abrupt change in the relative prices of the factors of production. Productivity and employment are the topic of section 5. The major impact of microelectronics on labor productivity and hence on jobs is examined. Section 6 discusses distributing the gains from higher productivity. Examined are the ideas of a guaranteed income, labor displacement because of automation, shorter work weeks, longer vacation time, and early retirement. The concluding section looks at "The Productivity Prospect." (RM)

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Productivity: The New Economic Context

Kathleen Newland

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As the decade of the seventies came to a close without producing a strong and sustained recovery from global economic recession, the spotlight of public concern focused on the problem of productivity. In all of the major industrial countries, the growth of productivity had plunged relative to its performance in the sixties. (See Table 1.) But for most of the seventies the attention of policymakers was, with good reason, riveted on the dramatic oil-price increases which began in 1973 and dragged the price of most other sources of energy along with them.

The oil shocks of 1973 and 1979 rocked the world economy on its foundations. They forced a drastic realignment of established price relationships among the factors of production—land, labor, capital, energy, and other raw materials. Faced in the eighties with petroleum bills that were at least ten times as high as those of the early seventies, consuming nations were compelled to use less oil. As a result, many of the industrial world's ways of producing goods and services rapidly became obsolete. Manufacturing processes, agricultural practices and service systems designed before 1973 mixed the factors of production according to a set of relative prices that disappeared as the price of petroleum soared.

The magnitude and abruptness of the price increase imposed by the Organization of Petroleum Exporting Countries (OPEC) diverted attention from some slower moving but equally important trends affecting other factors of production. Foremost among these is the enormous growth of the global labor force. Each year between 1950 and 1975, an average of 22 million additional people joined the ranks of the world's workers. In the final quarter of the century, the annual addition is expected to average 36 million people.[1] These huge increases, reflecting the population explosion of the post-war period, have a profound impact on the global mix of factors of production. Labor has become more abundant and relatively cheaper as other factors have become more scarce, expensive or both.

Unemployment in the 24 relatively affluent countries of the Organization for Economic Co-operation and Development (OECD) is ex-

6 pected to reach 28.5 million people in 1982, a postwar record of 8 percent of the labor force.[2] In the Third World, the problem is much more serious, though much more difficult to measure. But in many countries, both rich and poor, the need to use more labor (at least in the short run) has become at least as compelling as the need to use less energy.

Table 1: Productivity Growth, Selected OECD Countries

	1963-1973	1973-1981
	percent	
U.S.	1.9	0.2
Japan	8.7	3.8
West Germany	4.6	2.9
France	4.6	2.6
Britain	3.1	1.1

Source: OECD.

These twin imperatives complement one another to a degree. In many instances, resource consumption has been cut by substituting labor for energy and other raw materials. The 55 mile-per-hour speed limit in the United States, for example, cuts down fuel consumption by demanding more labor (in the form of driving time) from the driver of an automobile, bus or truck. The law contributes to the national goal of energy conservation, but in so doing it directly reduces the productivity of the driver: a straight swap of miles-per-hour for miles-per-gallon.

Measuring productivity and the ways it is affected by changes in the use of resources is not easy. Productivity is generally expressed as the value of goods and services produced (output) divided by the number of hours people spend producing them (labor). Measuring the value of all the inputs to the production process—capital, energy, and raw materials, in addition to labor—is such an immensely complicated task that it is seldom even attempted.

Using hours worked for pay to measure labor input may mask the economy-wide inefficiency caused by unemployment.

Dividing output only by the input of labor has two advantages apart from simplification. Labor efficiency is thought inherently to reflect the application of capital and resources to the production process. Simply stated, a worker using better materials and more powerful tools is likely to produce more. So other factors of production are indirectly accounted for in labor productivity. Second, output per hour of work relates the efficiency of production directly to the contribution of workers, so that the effect of productivity on the standard of living is easier to trace. Most references to productivity, therefore, refer to output per hour worked for pay. 7

Though this definition of productivity solves some problems, it creates others. Comparing the value of output to the value of only one input, labor, obscures the relative efficiency with which other factors of production are used. If the manager of a manufacturing plant makes a poor investment in a piece of capital equipment, the damaging effect on plant efficiency may appear, in productivity figures, to look like a deterioration in the quality of labor. Also, using hours worked for pay to measure labor input may mask the economy-wide inefficiency caused by unemployment, because unemployed workers simply drop out of sight in the productivity equation. A worker who becomes unemployed obviously reduces his output, but the decline would not be apparent in calculations that divide output by paid hours of work only. Economist Arnold Packer has suggested that a more useful measure of productivity for the economy as a whole would divide output by "hours potentially workable" in order to take account of labor wasted by unemployment.[3]

Assessing the value of output can be as difficult as keeping track of inputs. Prices do not always reflect changes in the quality or reliability of goods and services produced. For example, workers today may produce ten times as many calculators in an hour as was possible a decade ago. But if the price of calculators has fallen to a tenth the original level, no productivity increase at all would be recorded for the production worker. Inexpensive calculators, however, clearly do improve the general standard of living. Further problems arise in trying to measure intangibles such as the output of a symphony orchestra, a

police officer, or a bank president. It would be much more clear-cut to measure productivity in concrete terms of "widgets-per-hour," but the complexity and variety of goods and services produced in modern economies dictates that a universal measure like money be used to make them comparable. Price in the marketplace, however, is an imperfect guide to value; it is influenced by tradition, current events, monopolistic power, institutional restrictions, and so forth.

Perhaps the most difficult problems in measuring productivity involve those goods and services that never enter the marketplace. Many industries in the OECD countries have been required in recent years to devote more resources to pollution control and occupational safety and health, for example. These expenditures enter the firms' productivity equations, but the "output" of cleaner air and healthier workers does not. Similarly, most goods and services produced in households for direct consumption are not measured in conventional economic accounts. One of the most important structural changes in the Western industrial economies has been the movement of women into the paid labor force. Does a woman's contribution to the national standard of living increase when she reduces her work at home to start a paid job? The usual ways of measuring productivity give no help in assessing the economic impact of major social changes like these.

It is extremely important to understand the limitations of productivity as an indicator of economic progress. It can reveal a great deal about the future course of improvement (or deterioration) in the standard of living, but it cannot tell us why events unfold as they do. Most important, it says nothing about the social and political implications of changes in material standards of living.

The most serious productivity problems are undoubtedly found among the rural poor in areas where the population is pressing hard against the constraints of the environment, and it is here that conventional measures are most limited. A woman in a savannah village of Sudan must now spend half a day collecting the same load of fuel wood that she used to collect in an hour. Her productivity at that task

The United States continues to have the highest overall productivity of any country, but its margin has narrowed considerably.

has been reduced by three-quarters as the forest has receded from her village under the pressure of land-clearing, grazing, and fuel gathering. A similar plight affects the hill farmer in the Andes who watches his crop yields decline year after year, as the soil washes away from his fields, though he puts in the same long hours of cultivation. The nature and magnitude of the productivity problems faced by the majority of people in the Third World is so different from that affecting the industrial economies that it deserves full and separate treatment. The discussion that follows will not attempt the task, but will focus on productivity in the industrial, market economies.

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The current preoccupation with productivity in the industrial world centers around the question of how to raise it. Low and declining productivity is seen as a problem because it retards the material improvements that people in the affluent countries have come to expect or even demand. But there are larger issues to be addressed. High and rapidly rising productivity, which seems to be an adjunct of the new technology coming into use in virtually all segments of advanced economies, could become a problem in itself if some of the distributive issues associated with it are not grasped and solved. Who will benefit from high productivity? How can we ensure that enough people participate in the gains so that demand increases fast enough to absorb the increased production made possible by greater efficiency?

The recent past has seen a convergence of productivity levels among the industrial market economies. The United States continues to have the highest overall productivity of any country, but its margin has narrowed considerably. In 1960, for example, gross domestic product per employed person was four times higher in the US than in Japan, while in 1980 it was only 30 percent higher. U.S. productivity remained, in 1980, 40 percent above the level in Britain or Italy, and about 10 percent above that in France, Germany, Belgium, or the Netherlands. The growth of productivity in Japan and most of the European countries was well above the U.S. growth rate, however.[4]

10 The future course of productivity cannot be predicted with any certainty. A number of factors, such as the introduction of new technology and slower growth of the labor force in the industrial countries, will tend to boost productivity. At the same time, rising energy prices, greater efforts to curb industrial pollution, and economic policies that attack inflation by restraining economic activity all may work to restrain the growth of productivity. Japan and the Western industrial democracies are unlikely to repeat the heady days of the fifties and sixties, when output per hour grew at twice its prewar rate or better. In Japan, for example, productivity increased at a rate of nearly 9 percent per year between 1963 and 1973—a rate that seems virtually unattainable by the standards of the early eighties.[5] The economic context of productivity has definitely changed, and with it the criteria for making appropriate policy choices.

Why is Productivity Important?

Higher productivity is not an end in itself. It is, rather, a mechanism for improving the material quality of life. A rise in output per hour of work can finance increases in income, help restrain inflation, and enhance the competitiveness of products in the international marketplace. Each of these three beneficial effects sets the stage for economic growth. Rising incomes support demand for consumer products and public amenities, as well as providing a source of funds for investment. Low inflation creates a favorable climate for investment and risk-taking. The ability to expand sales to other countries permits specialization and economies of scale beyond the scope afforded by domestic markets. All three improve the standard of living.

Increases in the value added during an hour of work can be distributed in two ways: the return to the factors of production—labor, capital and raw materials—can be increased in the form of higher wages, higher return on investment, or higher prices paid for raw-material inputs. Alternatively, the increased efficiency can be passed along to the consumer in the form of lower prices for goods and services.

Either amounts to an increase in real income for someone, assuming that the same number of more productive hours are spent working. 11

An increase in wages (or the return to any other factor of production) that is not accompanied by a rise in productivity results in higher production costs. If these are passed along to consumers, they will lead to higher prices. If they are absorbed by enterprises, they will lead to lower profits. And if the discrepancy between wage hikes and productivity increases spreads throughout the economy, general inflation will erode the nominal wage gains until they equal the productivity gain. In Britain, for example, the general price level increased 107 percent between 1973 and 1979, reflecting a 111 percent increase in industrial wages while real output grew by only 4 percent.[6] Fair enough, one might say. But the trouble is that a whole national economy does not move in lock-step, and the discrepancy between wages and productivity will vary among workers.

Workers organized in strong labor unions, for example, or those possessing a rare skill in great demand, may have unusual power to negotiate wage increases in excess of their productivity gains. If the excess is higher than the general level of inflation, the effect of these workers' power is to redistribute income to themselves from others who have less economic clout. Over time, income distribution may become severely skewed, with wide discrepancies in the standard of living of the organized versus the unorganized, the skilled versus the unskilled—discrepancies based not only on relative productivity but also on relative power.

In addition to financing increases in income, productivity gains provide a check against inflation. What economists describe as the "basic inflation rate" is, precisely, the difference between nominal wage increases and productivity improvements. This rate excludes the inflationary impact of external shocks to the economy, such as the oil-price hike of 1973 and the poor harvest of 1972, as well as exchange-rate fluctuations. In the rather simpler economic world of the fifties and early sixties, the basic inflation rate was a fairly good guide to the price performance of the economy: oil prices and interest

12 rates were stable, and the value of currencies was fixed. If average wage increases in a given year were 6 percent while productivity gains were 3 percent, the general price level would go up by about 3 percent. In the eighties, however, factors external to this equation have become the major cause of inflation in most industrial countries. The weather, political decisions made by the oil-exporting countries, floating exchange rates after 1971, and the response of interest rates to all this and more, have had more of an impact on the rate of inflation in the last decade than has the gap between wage and productivity changes.

Even though wages have not been a leading factor in inflation since 1973, a fundamental connection remains between productivity and inflation. If productivity rises, wages can rise without pushing up the general price level. But at a time when elements other than labor costs are contributing so much to inflation, it is unrealistic to expect productivity increases to hold the line on prices.

Along with its effect on income and inflation, productivity plays an important role in determining how competitive a country's products are in international markets. If labor productivity in one country declines in relation to productivity in other countries that produce the same internationally traded goods, a competitive imbalance is created. If the higher costs of production are passed on, the country's industries will lose sales as customers turn to other, lower-cost suppliers. If the higher costs are absorbed by industries, their profit margins will shrink, perhaps to the point at which some manufacturers decide it is no longer worthwhile to compete. A third possibility is that production costs will be held stable by lowering real wages.

Countries that fail to keep pace with the productivity gains of competitors often try to preserve their place in international markets by devaluing their national currencies. In the short run, devaluation lowers real income in the devaluing country. It does this in two ways: by making imported goods more expensive, and by boosting domestic inflation. The weakness of the U.S. dollar in 1977 and 1978, for example, added by some estimates as much as two percentage points to

Because productivity affects the relative value of currencies, it helps determine how much a country benefits from buying and selling abroad.

the U.S. rate of inflation, sending it into double digits. In the long run, however, devaluation may improve economic performance by lowering the price of exports, which may make the difference between growth and stagnation of the domestic economy. In the aftermath of the dollar's devaluation in 1977-78, U.S. exports grew twice as fast as world trade in general, and accounted for 60 percent of the U.S. economy's growth between 1978 and 1980.[7]

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A strong currency obviously has the opposite effect. Countries that buy goods from another with a strong currency must give more of their own goods or currency in exchange. In the short run, a high exchange rate improves the standard of living, but it may eventually undermine economic growth if other countries turn to less expensive suppliers. A strong currency may pose severe problems if it is based on something other than high productivity. Britain provides a current example: productivity increased very little in the late seventies and actually fell through most of 1980. But wages in manufacturing continued to rise. Normally, one would have expected the pound to weaken as a result, keeping the price of exports at a reasonable level. But an external factor, North Sea oil, prevented a deterioration of the pound. British export industries suffered a triple blow: rising wage bills, falling productivity, and an expensive currency. Output in British manufacturing, heavily dependent on foreign markets, fell by 17.5 percent in two years.[8]

As trade becomes an increasingly important element in most national economies, productivity trends have a greater effect on the standard of living. Because productivity affects the relative value of currencies, it also helps determine how much a country benefits from buying or selling abroad. Between 1948 and 1973, world trade expanded by 7 percent a year, spurring economic growth and efficiency in the countries that were able to participate, but also making them less self-sufficient. In 1960, only 10 percent of the gross national product of the United States was made up of imports and exports. In 1980, the proportion was one-quarter. Most other Western industrial countries, as well as Japan, have much higher proportions of their economic activity affected by trade. For all, productivity is no longer an exclusive-

14 ly domestic concern, but must be considered in relation to the productivity of foreign trading partners.[9]

Considering the important role that productivity plays in determining real income, inflation, and competitiveness, it is no surprise that policy makers in the advanced industries are trying hard to discover the causes of the current slowdown in productivity growth. One important clue to the mystery is the changing structure of their economies.

Structural Shifts in the Economy

The idea of productivity increase typically brings to mind a new piece of labor-saving machinery, a streamlined set of office procedures, or a faster-moving assembly line. Within particular businesses, such innovations have indeed raised output per hour of work. But for national economies, the major engine of higher productivity has been structural change—the wholesale movement of workers out of less-productive sectors of the economy into more productive ones.

Historically, the most far-reaching structural change has been the shift from agriculture to industry. This has been going on since the Industrial Revolution, and it continues to be a source of high growth of productivity in many developing countries. In most of the advanced industrial countries, the number of people employed in the primary sector (including agriculture, forestry, and fisheries) has become so small that this historical source of productivity growth has very limited potential as a source of future growth. (See Table 2.) In Britain, for example, less than 3 percent of the civilian labor force works in agriculture; in the United States, less than 4 percent do. Of the 24 OECD countries, only a handful have more than 15 percent of their civilian workers in the primary sector.[10]

The shift from agriculture to industry fueled an economy-wide increase in productivity that surpassed productivity growth within any one sector. In the United States, for example, both farm and nonfarm productivity grew by 2.1 percent per year between 1910 and

Table 2: Civilian Employment by Economic Sector, Selected OECD Countries, 1980

Country	Total Civilian Employment	Proportion Employed in:* Agriculture	Industry	Other
	(thousands)		(percent)	
Australia	6,242	7	31	63
Canada	10,655	6	29	66
France	21,142	9	36	55
West Germany	25,265	6	45	49
Greece	3,347	30	30	40
Italy	20,572	14	38	48
Japan	55,360	10	35	54
Netherlands	4,669	6	32	62
Spain	11,254	19	36	45
Sweden	4,232	6	32	62
Switzerland	3,012	7	40	53
Turkey	14,610	60	16	23
United Kingdom	24,397	3	38	59
United States	97,270	4	31	66

*Totals may not add to 100 percent because of rounding.
Source: OECD.

1960. Overall productivity, however, grew by 2.4 percent, reflecting the movement of workers to non-farm jobs in which the absolute level of productivity was higher. At the beginning of the postwar period, average hourly output in agriculture was only 40 percent of the national average. Each hour of labor transferred from agriculture to an industry with average productivity resulted in a 60 percent gain in output per hour. Between 1948 and 1965, 9.1 billion hours were shifted out of the agricultural sector, giving a huge boost to aggregate productivity. Since 1965, however, the transition has slowed to a virtual halt; fewer than 0.1 billion hours of labor were released from agriculture between 1972 and 1979. Economist Lester Thurow calcu-

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lates, on the basis of these figures, that the completion of this structural shift accounts for roughly one-tenth of the slowdown in U.S. productivity in the late seventies as compared to the 1948-65 period.[11]

Productivity in the Soviet Union has had a similar structural boost since World War II. The transition from agriculture to industry in the Soviet Union is far from complete, though, and overall Soviet productivity is still only 57 percent as high as that in the United States. Still, changes in the allocation of labor between sectors has had an enormous impact. In 1940, 28 million Soviet citizens were employed in agriculture and 13 million in industry. By 1978, the farm labor force had declined to 23 million, but industrial workers numbered 36 million—a change that helped to raise the Soviets' production of goods tenfold during this period. The potential for further productivity increases remains. Twenty-two percent of the civilian labor force continues to work in low-productivity farm jobs, a reflection of deep-seated inefficiencies in the agricultural sector.[12]

As the shift from agriculture to industry was winding down in the developed countries, a second historic structural change was moving labor from goods-producing industries into service-producing industries. "Goods production" is usually taken to mean agriculture, manufacturing, mining, construction, transportation and utilities, though sometimes the last two are classified as services. The service sector includes wholesale and retail trade, finance, insurance, real estate, personal services, business services and government. Jobs in the service sector have been by far the most important source of new employment in the OECD industrial countries in the seventies. For one thing, they have proved to be relatively recession-proof. The number of service jobs in the United States continued to rise through each of the four economic slumps of the seventies, as jobs in goods production fell sharply. (See Table 3.) In Britain, between March 1979 and March 1981, the number of people employed in manufacturing fell by 14 percent, while the number in services declined only 2½ percent. Even in Japan, with its heavy emphasis on industrial production, employment and consumer spending have shifted to the service sector, which now accounts for more than half of each.[13]

Table 3: Changes in US Employment by Sector During Economic Downturns 17

Period of Slump	Change in Number Employed in Goods Production	Change in Number Employed in Services Production
(month and year)	(thousands)	
12/69-11/70	−1,651	+ 796
11/73-3/75	-2,736	+1,298
1/80-7/80	−[illegible],234	+ 507
7/81-12/81*	− [illegible]98	+ 114

*Not the end of this recession
Source: *Wall Street Journal*, January 15, 1982.

The United States has been the leader in this transformation. By early 1982, nearly three-quarters of all non-farm U.S. employees worked in businesses that produced services rather than tangible goods. Even this figure actually understates the rise of service jobs, for nearly a third of the people who work in goods-producing businesses have service occupations; they are clerical workers, managers, messengers, security guards, janitors and such. Two-thirds of the nation's self-employed workers also produce services. The pace of the transformation accelerated sharply in the seventies. Of the 18.7 million net new jobs created between 1970 and 1980, only about one million were in manufacturing.[14]

The effect on productivity of this second major wave of structural change is controversial. There is no dispute among economists that productivity in the service sector has tended to climb more slowly than productivity in general in the postwar period. But there is some disagreement about absolute levels of productivity in services and about likely shifts of employment within the sector. Much of the controversy arises because the service sector is so heterogeneous. It includes highly paid bankers, physicians and journalists as well as low-paid file clerks, parking-lot attendants and hairdressers. It also

18 includes a great many people whose output is almost impossible to quantify: teachers, football stars, artists, politicians.

A recent study by the American Productivity Center emphasized that average value-added per hour worked in the service sector of the U.S. economy is actually higher than that in the goods-producing sector: $7.57 worth of output per hour in services in 1980 as opposed to $7.37 in goods (1972 dollars). Thus, the movement of workers out of goods and into services should boost aggregate productivity just as the shift from agriculture to industry did, though perhaps not so forcefully. Other observers, however, such as Emma Rothschild of the Massachusetts Institute of Technology, point out that the biggest employment gains of recent years have been in those parts of the service arena where productivity is lowest. Two sub-sectors, business-and-personal services and retail trade, with average output per hour only 62 percent and 64 percent respectively of the national average, provided 70 percent of all the new private jobs in the United States between 1973 and mid-1980. Rothschild notes, "the *increase* in employment in eating and drinking places since 1973 is greater than total employment in the automobile and steel industries combined." If this pattern continues, further shifts of employment into the service sector would lower average productivity within the sector, and in the economy as a whole.[15]

The general tenor of discussion on the problem of stagnant or declining productivity still tends to focus on the part of the economy that produces tangible goods. With more than half of most wealthy countries' labor forces employed in the service sector, this is tackling only half the problem—and it may be the wrong half. Productivity in manufacturing has advanced strongly in the postwar period, even in the recession-plagued seventies. The index of manufacturing production compiled by the U.S. Federal Reserve Board, for example, gained 38 percent between 1970 and 1980, while the number of production workers rose by only 1.4 percent, and all employment in the goods-producing sector gained only 8.2 percent. Productivity gains accounted for the disproportion between the growth of output and the growth of employment.[16]

Productivity in manufacturing has advanced strongly in the postwar period, even in the recession-plagued seventies.

Most analysts expect that new technology and new forms of organization will significantly boost productivity in the service industries. Microelectronic technology has already begun to alter the labor-intensity of some service occupations as electronic bank-tellers, computer-linked cash registers and word processors become commonplace. The market for the sophisticated machinery of office automation may increase by as much as 40 to 45 percent per year through 1985, according to one estimate.[17] Increasing standardization and economies of scale are also raising productivity in some of the least productive segments of the service sector: substituting supermarkets for small neighborhood shops, and franchised hotels and restaurants for independent establishments, may sacrifice charm and individuality —but it has increased productivity.

The prospect of greatly increased productivity in services means that a continued movement of jobs into the service sector could indeed act as a locomotive for overall productivity and economic growth. This possibility only will be realized, however, if the labor saved in making businesses more efficient is employed elsewhere in occupations of equal or higher productivity. This is possible on a large scale only in a growing economy. If bank-tellers surrender their places to an automatic teller in order to become computer programmers, their personal output per hour and the national average will rise. If they leave to become dishwashers or, worse, to become unemployed, both they and the economy as a whole will suffer.

Changing Relationships Among the Factors of Production

At the root of the current crisis in labor productivity is an abrupt change in the relative prices of the factors of production. Resource constraints and politically motivated disruptions of supply have sent prices of many raw materials, led by oil, soaring. The price of capital investment, as indicated by interest rates, has also increased rapidly—though certain kinds of capital goods such as microprocessors and robots have become cheaper. At the same time that natural resources and capital became more difficult to obtain, the global labor force

20 swelled in size. This increase held down the price of labor relative to the rapidly escalating price of capital and raw materials; indeed, in some countries—Britain, Bangladesh, and the United States among them—real wages declined absolutely during the late seventies. It should come as no surprise, therefore, that producers tried to conserve capital and energy by using more labor. The productivity of other factors of production was enhanced at the expense of labor productivity.

The explosive growth of the labor force in the sixties and seventies reflects both demographic and social changes. It is in large part the legacy of the high birth rates and low mortality rates of the postwar period, which together sent world population soaring from 2.5 billion in 1950 to 4.4 billion in 1980. By the mid-sixties, the first flush of the baby boom was beginning to reach the job market. The United States, relatively undamaged by World War II, was the first to experience the postwar rise in fertility, and therefore the first to feel the impact of the unprecedented number of new job seekers. Between 1970 and 1980, the number of men and women in their prime job-hunting years, 18 to 34, expanded by one-third, rising from 49 to 66 million. At the same time, the number of women entering the labor force was steadily rising. Starting from a level of 38 percent in 1950, 52 percent of all women over age 16 were in the work force by 1982. Among women aged 25 to 54, two out of three were employed.[18]

To accommodate this combination of demographic and social change, there was a net increase of 19 million new jobs in the US between 1970 and 1980, increasing employment by 24 percent. By contrast, the ten countries of the European Economic Community, yet to bear the full brunt of the baby boom and lagging somewhat in the employment of women, created only two million new jobs, a 2 percent gain over 1970. On both sides of the Atlantic, however, unemployment grew along with employment. In the OECD industrial countries as a whole, the number of unemployed at the end of 1980 was 17.2 million, up from 10.2 million seven years earlier. It was expected to top 28 million in 1982.[19]

Increasingly, workers in the industrial market economies have had to compete not only with each other but with labor from the Third World. The growth of the labor force in the OECD countries was dwarfed by the increased number of people who reached working age in the developing world, by a ratio of 3.5 to 1 in the period 1950-1975. China alone will be adding about 25 million youths to its labor force each year in the eighties as it absorbs the baby boom of the sixties.[20] Though productivity tends to be lower in the developing countries, wages typically are so much lower that the total cost of production is competitive. Both in traditional labor-intensive industries, such as textiles and garment-making, and in heavy industry such as steel and shipbuilding, competition from Third World producers exerts downward pressure on wages in the industrial countries. In the process, two different and somewhat contradictory kinds of pressure are brought to bear on productivity in the competing industries. On the one hand, producers in high-wage countries must try to increase productivity in order to hold down production costs despite paying higher wages than their foreign competitors. At the same time, however, the restraining influence of competition on wages encourages producers to use more labor, rather than investing heavily in capital equipment—which tends to reduce the growth of productivity.

As the eighties progress, the extraordinarily large number of people born in the industrial countries during the fifties and early sixties will be assimilated into the labor force. The demographic contribution to high rates of labor force growth will dry up. The social factors are more difficult to predict. Women's labor force participation is still well below men's, and it will probably continue to increase. The retirement age may drift upward, as health and longevity improve. Economic pressures may also persuade many older people to stay in the labor force. However, it is fairly certain that the labor force in the rich industrial countries will grow much more slowly in the eighties than it did in the seventies. There will be 15 percent fewer people aged 18-24 in the US in 1990 than there were in 1980, for example.[21] Other things being equal, a tighter labor market should favor an increase in productivity.

22 The decline in productivity growth rates that has caused such great concern in the industrial democracies is in one sense a perfectly rational response to the sudden expansion of the labor force in relation to the other factors of production. In the United States, hours worked grew eleven times faster between 1977 and 1979 than in the period from 1948 to 1965—4.4 percent per year as opposed to 0.4 percent in the earlier period. Capital investment also grew during the seventies, but not quickly enough to keep up with the larger labor force. Economist Lester Thurow illustrates the relationship with figures from 1978: in that year, U.S. capital stock rose by 3.4 percent, but hours of work increased by 4.8 percent. The ratio of capital to labor used, therefore, declined by 1.3 percent. Thurow concludes, "Unfortunately, from the point of view of productivity, economic signals have been calling for a slowdown or reduction in the capital-labor ratio. . . . A more slowly growing capital-labor ratio inevitably leads to lower productivity growth."[22]

To support this claim, Thurow compared the cost of new capital equipment with the cost of labor in two periods, 1945-1968 and 1972-1979. In the cost of capital he included not only the purchase price of new equipment, but also the energy costs of running it and the interest-rate costs of financing it. Labor costs included wages and fringe benefits. Making this comparison, he found that while total capital costs fell relative to total labor costs by 1 percent per year in the earlier period, they rose relative to labor by nearly 6 percent per year after 1972. It is understandable, therefore, that the U.S. factor mix tilted in favor of labor during the seventies. With less capital investment per worker, output per hour of work grew slowly, if at all.[23]

Much of the capital investment that did take place in the seventies did little to raise labor productivity. Instead, it was directed toward retooling the industrial market economies to adjust to higher energy prices. New production processes and new kinds of equipment were needed to balance the factor mix in the light of the new price relationships. As the price of a barrel of oil rose from $3 in 1973 to about $36 in 1980 before dropping back slightly in mid-1982, a considerable amount of capital stock became obsolete. Particularly in such energy-

intensive industries as steel, autos, petrochemicals, aluminum, paper-pulp, and shipbuilding, equipment designed to use energy priced at 1973 levels urgently needed to be replaced or used less intensively. 23

Harvard economist Dale Jorgenson maintains that the drastic change in energy prices during the seventies is the single most important cause of declining growth of productivity and hence of declining economic growth. He argues that energy and labor substitute easily for each other in most production processes. As producers cut back energy use and capital investment (because of the high energy costs of operating equipment), their only recourse is to use more labor. Thus, demand for labor tends to follow energy prices upward. Even though more hours are worked, however, total output may not rise commensurately: Jorgenson estimates that the adjustment to higher energy costs will reduce U.S. economic growth by 0.75 percentage points annually in the early eighties, even if the rise in energy prices moderates. This would be a big dent since economic growth (as measured by the Gross Domestic Product) averaged only 3.9 percent a year in the late seventies—and only 1.75 percent from 1980 to 1981.[24]

In addition to producing structural changes that tend to lower labor productivity, high oil prices reduce productivity in at least two other ways. The current world price of oil makes it profitable to exploit oil deposits that would not have been considered commercially valuable before 1973. These tend to be, for geological or geographical reasons, more difficult and expensive to bring into production. Whether from heroic attempts to recover more oil from nearly depleted wells, new off-shore drilling operations in the stormy North Sea, or exploration of remote oil fields in frozen Siberia, more hours of labor are required to produce a barrel of oil from these newly-viable sources. Similarly, the price of coal, natural gas, and other alternative energy sources has been driven up by the price of oil, making low-yield deposits worthwhile.

The energy experience even of the nonmarket Soviet economy reflects this phenomenon. In 1960, the regions east of the Ural mountains,

24 including Siberia and the vast southern deserts, produced only 7 percent of the USSR's oil, 36 percent of its coal, and 2 percent of its natural gas. By 1980, these mostly inhospitable and sparsely populated areas produced 40 percent of the oil and nearly half of both coal and gas. Between 1965 and 1975, coal mines had to be deepened by an average of 85 meters. Inputs of labor and capital had to be greatly increased in order to maintain production from such difficult sources. For similar reasons, mining productivity in the United States in 1979 was only 72 percent as high as it was in 1972, and four-fifths of the decline could be traced to the oil sector of the industry.[25]

Another way in which higher energy prices depress productivity growth is, ironically, by encouraging conservation among consumers. The utilities that deliver energy to users employ far more people to maintain their distribution networks than actually to produce energy. The same amount of labor is needed to maintain the networks almost regardless of how much energy is being delivered. As higher energy prices encourage consumers to reduce their energy use, the output of delivered energy per utility worker automatically falls. In the United States, falling productivity in electrical and gas utilities accounted for 10 percent of the total productivity decline during the late seventies.[26]

Because the price of oil increased in such sudden and dramatic bursts in 1973 and 1979-80, energy costs have tended to dominate discussions of the changing relationship between the factors of production. But other raw-materials prices were subject to the same kind of escalation, though in less extreme forms, that energy prices displayed in the seventies. Demand for minerals has been sluggish in the face of recurring global recessions, but even so, employment in mining has not fallen. As the richest and most accessible sources are mined out, the need to exploit lower grades of ore in more difficult locations has called for more intensive use of labor. The result can be seen in a declining rate of productivity growth in mining, despite increasing automation. Output per hour in U.S. copper and iron mines rose by only 1.3 percent per year in the period 1967-79, compared to a productivity growth rate of 3.5 percent per year between 1947 and 1966.[27] Should economic recovery bring about a hardening of miner-

Labor productivity in agriculture in the advanced countries has soared during the postwar period, rising faster than productivity in the economy as a whole.

als prices, exploitation of increasingly marginal mines would become profitable, which would be likely to depress labor productivity further. 25

As the cost of obtaining nonrenewable materials rises, the economic rationale for the three R's—repair, reuse, and recycling—becomes more compelling. Each of the three is a way of substituting labor for both energy and raw materials. The energy required to produce recycled aluminum, for example, is only 4 percent of the energy needed to produce aluminum from bauxite ore.[28] Workers who produce aluminum cans from trash instead of from crushed rock may have lower productivity in the strictly conventional sense, for recycling is a more labor-intensive process than smelting. But in reality, these workers are producing the same product at a much lower net cost to society. The same might be said of repair workers as opposed to production workers. Someone who fixes a broken clock "produces" a useful device with much the same practical effect as the worker who made the original clock. But the "value added" in repair is considered to be less than in production, so the productivity of repair workers is lower. A society that turns away from planned obsolescence will need to distinguish this source of declining labor productivity—which is a sign of better economic health—from other sources that may flag inefficiency and waste.

In the long run, one area in which the factor mix—the combination of raw materials, labor and capital used in production—may have to shift radically is agriculture. Labor productivity in agriculture in the advanced countries has soared during the postwar period, rising faster than productivity in the economy as a whole. On German dairy farms, for example, one farmhand was needed for each ten cows kept in 1950; the 1980 worker could take care of 40 to 60 animals. Since 1970, U.S. farm-labor productivity has increased by 5.5 percent a year, while productivity in nonfarm businesses grew only 1.5 percent a year.[29]

Some of the productivity increase in farming has come about through more extensive farming. Whereas German farms in 1950 typically employed one worker for every 18 hectares farmed, they now use one

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worker per 100 hectares.[30] In the United States, the characteristic family farm has gone from being 40 acres and a mule to 400 acres and a mighty array of agricultural machinery. But modern farming has become less labor intensive at the cost of becoming much more intensive in its use of capital, energy, chemical fertilizers, pesticides, and, in some cases, water. Most seriously, farming has become a more aggressive consumer of the most fundamental material input, the land itself.

There is tremendous concern that the pressure to increase farm productivity per worker and per hectare is leading to accelerated soil erosion. A United Nations survey in 1977 reported that nearly one-fifth of the world's cropland is being steadily degraded by erosion, reducing its natural productivity. Such losses can often be masked by using more fertilizer, but at an increasingly high cost. Lester Brown of Worldwatch Institute has analyzed the relationship between world grain production and world fertilizer use. He found that during the fifties, each additional million tons of fertilizer used was associated with an increment of over 11 million tons of grain harvested. By the late seventies, each new million tons of fertilizer was producing a net gain of only 6.8 million tons of grain.[31]

Brown also calls attention to the limited prospect for expanding cultivation onto new lands. Only a few regions, such as the Sudan, the tsetse fly belt in Africa (assuming that the fly can be brought under control), and the southern plains of Brazil, have great potential as new farming areas. The Food and Agriculture Organization (FAO) reinforces the point, reporting that "By the end of the century, no less than 42 percent of Africans will live in countries with less than 10 percent of total cultivable land left to expand into. The proportion for Asia will be 80 percent, and for the Near East 87 percent." At the same time, the FAO says, total demand for food in the developing countries will grow by 3 percent a year between 1980 and 2000.[32]

The rising cost of energy-intensive agriculture inputs, the limited availability of new land, and the urgent need for more careful hus-

bandry to prevent serious erosion, all argue for more intensive use of labor in agriculture—especially in the hungry nations of the Third World where labor is virtually the only factor of production that is superabundant. But even in the countries that are agriculturally most advanced, the need to use energy and land resources more prudently will dictate greater labor intensity.

Many of the soil-conservation measures desperately needed to prevent a long-term decline in productivity of agricultural land may reduce labor productivity, at least in the short term. Contour plowing, strip cropping, terracing, planting shelter belts and such use more labor than fence-to-fence, straight-line, monocultural row-cropping. Furthermore, the extra input of labor does not immediately produce a bigger harvest. It is an investment in sustainability whose returns may not make themselves evident for a generation. Longer-term prospects for productivity increases in farming are difficult to predict. Basic research in plant genetics now in progress may produce innovations whose practical application could dramatically increase yields per hectare and yields per hour worked.

In industry and services, as well as in agriculture, human ingenuity and the application of acquired knowledge is almost in a separate class as a factor of production. The growing need to conserve energy, capital, land and materials will be met, more and more, with an intensive application of human brain power rather than human muscle power. New technology is the physical embodiment of new knowledge, and the speed and comprehensiveness with which it is changing methods of production has been accelerating throughout the seventies. In a decade of sluggish economic growth, the most dynamic industries were the knowledge-intensive industries, which use all the traditional factors of production—capital, labor and raw materials—more efficiently than has ever been possible in the past. But it is the very ability of the new technology to raise labor productivity that has given rise to a new set of fears about the future relationship between productivity and employment.

28 Productivity and Employment

Between 1811 and 1816, over one thousand textile mills in Britain were destroyed by enraged weavers who were convinced that their livelihoods were threatened by the introduction of the power loom.[33] Their revolt was suppressed, and the textile industry went on to become not only the foundation of British industrial might, but also the largest employer in the manufacturing sector. The productivity increases associated with the new looms made it possible to lower the price of cloth so much that even the poor could afford to buy it. The market for cloth expanded and production soared, along with the standard of living of the masses. Even the textile workers were somewhat better off.

If the Luddites, as the rioters were called after one of their leaders, had not existed in historical fact, they would almost have had to be invented. Their example has been used to soothe generations of workers concerned that higher productivity brought on by technological advance would cause them to lose their jobs. The fear is not at all new; what is new today is the pace of technological change and its pervasiveness in virtually all sectors of the economy.

Electronic technology, with its extraordinary versatility and its rapidly declining cost curves, is at the forefront of the change. Unlike most capital goods, the cost of microelectronic circuits and the devices incorporating them have plunged relative to labor costs. Technical advances in the microelectronics industry, combined with fierce international competition among producers, turned the semiconductor from a costly, exotic lab specimen into a household item in scarcely more than a decade. The price of a silicon chip capable of storing 16,000 bits of information fell from $20 to $5 in less than a year, and then to $1.50 after another 18 months. A Unimation robot that cost $40,000 in 1981 could be expected to work two shifts a day for eight years at a cost of $5 per hour, including service and depreciation. By comparison, a typical assembly line worker in the U.S. would draw $15 an hour in wages and benefits.[34]

At an Australian die-casting plant, one worker and a robot now operate die-casting machines that used to require eight laborers.

More than 100,000 products on the U.S. market alone now contain semiconductors. Less labor is used to manufacture these products than is used for their mechanical equivalents. For example, when the Italian firm Olivetti switched from making electro-mechanical machines to entirely electronic ones, the proportion of the total labor force involved in production fell from 45 percent to 31 percent. A similar product change at National Cash Register in the US allowed it to reduce its manufacturing work force by more than half. The labor-saving capability of microelectronic equipment carries over beyond the manufacturing stage. Western Electric, the manufacturer of telephone equipment, estimates that the shift to electronic products will ultimately cut back its need for labor in maintenance, repair and installation by 75 percent.[35]

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The major impact of microelectronics on labor productivity and hence on jobs, however, lies not in the manufacturing techniques for electronic consumer products, but rather in the use of electronic capital equipment—computers, robots, computer-aided design systems, word processors, and sophisticated communications systems. In both the service sector and in manufacturing industry, such equipment has the capacity to multiply the output per hour of human labor—or, to put it another way, to produce the same output with a greatly reduced labor input. At an Australian die-casting plant, one worker and a robot now operate die-casting machines that used to require eight laborers. At a Sanyo television factory in Japan, new automated machinery on an assembly line allowed a reduction of the line's labor force from 120 to 20 women.[36]

In services as well, higher productivity in the wake of the microelectronic revolution is expected to reduce the demand for labor in some kinds of jobs. A recent study of Germany's wholesale and retail trade sectors predicted that employment would drop by 10 percent by 1990, eliminating 310,000 jobs. A 1978 report to the French government concluded that as many as 180,000 jobs in the French banking and insurance industries could become redundant by 1990, equal to 30 percent of the industries' current employment. At the Atlantic Richfield Company headquarters in Los Angeles, the first corporate de-

partment to install a computer-linked system of word processors operates with a one-to-nineteen ratio of secretaries to professional staff, compared to a one-to-five ratio in the other departments.[37]

Microelectronics is by no means the only source of productivity growth in the economy today, though it is perhaps the fastest-moving. In the service industries, for example, productivity is also being raised by new managerial methods, such as the centralization and standardization pervasive in fast-food restaurants as opposed to corner cafes, or in supermarkets as opposed to mom-and-pop grocery stores.[38] Economies of scale are still being realized in certain businesses such as hotel chains, franchised restaurants, and car-rental agencies. New approaches to the organization of job content, particularly approaches that involve greater cooperation between labor and management, often yield productivity increases without any new investment being made in plant or equipment. Probably the best known example of a mechanism for such "soft" productivity increase is the "quality circle" much in vogue among students of Japanese management. Like technological change, these managerial and organizational innovations make it possible to increase output without increasing labor commensurately.

The fear of high and intractable unemployment springs from the understanding that with higher productivity, fewer workers are needed to produce the same volume of goals and services. The *Economist* of London observes, "that is simple arithmetic. It is not economics."[39] Higher productivity enables the same goods or services to be sold more cheaply which, typically, raises effective demand for them because more people can afford them and consider them worth the price. Output therefore is likely to expand, employing at least some of the labor that would have been displaced by straight capital-for-labor substitution in a static market.

Of course, not all markets for specific goods or services can or should expand indefinitely. But massive technological unemployment, predicted since the dawn of the Industrial Revolution and with particular vigor in the computer age, so far has not materialized. Part of the rea-

Currently, one of every 200 workers in the U.S. labor force is either a computer programmer or a systems analyst.

son is that more productive workers earn more, and spend what they earn on goods and services produced by others, so that demand increases with productivity. Another part of the reason is that new technologies and new forms of organization bring with them new demands for labor, both in industries that produce the new system and in those that use them. For example, as the numbers of computers in use worldwide tripled from 300,000 to 900,000 between 1975 and 1981, employment in the computer equipment industry grew; in the United States, it doubled in the eight years leading up to 1980. By 1985, nine million computer systems are expected to be functioning.[40]

The production of computer hardware, however, accounts for only a fraction of the growth in employment associated with expanding use of the technology. Software—information that tells the computers what to do and how—now accounts for 80 percent of the cost of a computer, and most of that goes to pay programmers and systems analysts. Computer software is a highly labor-intensive industry, though the more routine elements of it are now being automated. Currently, one of every 200 workers in the U.S. labor force is either a programmer or a systems analyst. Other advanced economies are expected to reach this proportion over the next decade, while in the United States the figure will probably increase slightly.[41]

The computer industry, therefore, could follow the example of the telephone industry, in which staggering productivity increases have been accompanied by substantial employment growth. In 1910, the Bell System in the United States employed 120,000 people and transmitted six million telephone calls. Average productivity was 50 calls per year. Bell's 1979 staff of one million handled 185 billion calls—an average of 185,000 per employee. Today's telephone traffic obviously could not exist without such an advance in productivity—at 1910 productivity levels, the labor force needed to transmit it would be equal to 40 times the entire U.S. labor force.[42]

The idea that demand is fixed at a certain level, that the work required to meet it must be divided up among all available workers, and that

32 raising productivity reduces the number of people who can participate in production, is labeled the "lump of labor fallacy." In fact, no modern society has ever come close to total market saturation. Particular markets in particular countries—automobiles in the United States or color televisions in Japan—perhaps have. But even in the most affluent countries, new wants and needs constantly arise as economic development creates new possibilities. Among the less affluent, many people lack even the basic goods and services needed to sustain themselves. And in every country, public needs—aid to the disadvantaged, care of the environment, education for a new technological age—go unfulfilled.

Even the most wild-eyed technological optimist, however, will admit that matching the capabilities of production to the needs of society is neither simple nor automatic. The OECD, while asserting confidently that rising output and new kinds of jobs will offset any loss of employment arising from technological change, does acknowledge the likelihood of structural problems within different sectors of the economy. Employment in certain industries has declined and will continue to do so. During the process of retooling for higher productivity in order to remain internationally competitive, West Germany's textile industry shed 102,000 jobs during the seventies. Employment in the U.S. auto industry is unlikely ever to fully recover its pre-slump level of employment, because the slow growth of its market coincides with a period of intensive automation. Japanese economic policy encourages the shift of resources away from old-line heavy manufacturing industries, such as ship building and steel, into electronics and other energy-efficient, technologically sophisticated businesses.[43]

Even if rising employment in the growth industries is vigorous enough to provide as many jobs as are lost to structural change (plus enough to absorb the unemployed) there is no guarantee that the same workers who are displaced will be in a position to benefit from the new opportunities. They may live in the wrong place, bound by financial and familial ties, or they may have inappropriate training and inadequate access to retraining. A laid-off steel worker cannot

metamorphose into a software engineer overnight, even though steel workers are superabundant and software jobs go begging. The pace and scope of the current wave of technological change magnify the problem of adjustment to structural changes. Millions of workers, along with their communities, are caught in the lag, suffering the economic and psychological deprivation covered by the bland term "transaction costs." The adjustment of employment to structural change is slower and more painful in periods of slow or negative economic growth, since jobs in weak industries tend to disappear faster while jobs in emerging fields materialize more slowly. This in itself slows the rate of growth of productivity.

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Higher rates of economic growth are desired not only because they improve the standard of living, but also because they are assumed to create employment. If high rates of productivity growth are restored, as is the avowed aim of economic policy in all the advanced industrial economies, that assumption is called into question. Employment in manufacturing in the West declined in the seventies as a proportion of total employment, even though output grew. Jobless growth has long been an established phenomenon in agriculture, where a declining number of workers has continued to increase output. The same pattern seems to be taking hold in some segments of the manufacturing sector. Paul Strassman, the vice-president for strategic planning at Xerox Corporation, says that the company's labor force, which has increased slightly since the mid-seventies, "is putting out 200 percent more output, which is 500 percent higher in quality."[44] An OECD survey of the electronics industry, done in the late seventies, showed that none of the 40 largest companies in the industry expected any increase in its labor force, though all expected to invest heavily if the market for their products continued strong.[45] With automation also beginning to affect jobs in the services industries, many people are wondering where new employment opportunities will be found in the eighties.

David Cockroft of the International Foundation of Commercial, Clerical, Professional and Technical Employees anticipates that rising

34 office productivity could cut office employment in Western Europe by five million in ten years. He writes:

> "It is of course fallacious to suppose that output is autonomously determined without reference to productivity. But it is equally invalid to suppose that output automatically adjusts to provide full employment whatever the rate of productivity growth. If it did, there would not be over 20 million registered unemployed in the OECD area alone and 300 million under-or unemployed in the developing countries. High growth rates and rising living standards in some sectors coexist with high unemployment and poverty in others, creating a dangerous and worsening world economic environment that threatens the process of technical change on which rises in living standards depend."[46]

The great danger in the dual economy described by Cockroft is that rising productivity in a stagnant economy will spin more and more people out of the economic mainstream. If people have neither jobs nor an alternative source of an equivalent income, their consumption will inevitably fall—and with it, demand for the goods produced under jobless growth. The productive economy could under those circumstances wind itself into an ever tighter and more exlusive spiral serving the real needs of fewer and fewer people. The central problem in managing high productivity growth, then, is how to distribute the gains in such a way that effective demand for goods and services is high enough to sustain a level of economic activity that can meet people's needs.

Distributing the Gains from Higher Productivity

On the surface, it is puzzling that the prospect of sharply increasing productivity should be greeted with alarm. It has, after all, been the chief engine of material progress for the last two hundred years. Furthermore, the cost of low productivity is well known: poverty. The alarm springs from the anticipated effect of rising productivity on employment; plainly, the same or even a growing amount of

Already there are a few totally automated assembly lines operating "ghost shifts" in West Germany and Japan.

goods and services can be produced with fewer hours of labor each year. But why should this be a cause for concern? What is it that is frightening about a world in which people can play queen bee to the microprocessors' drone?

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Utopian visions of a leisured society have never quite taken hold of human aspirations. The reason is surely that modern industrial societies have assigned to employment a role that goes beyond production: employment is the chief mechanism for income distribution in modern society. More traditional societies have conferred a claim to resources on the basis of a citizen's personal status and his or her fulfillment of obligations. But today, most advanced economies allocate the fruits of production to people primarily on the basis of their jobs. The family serves as a secondary channel of distribution, where members who work in the cash economy share income with those who do not. Some institutions, most prominently governments, also transfer income between groups. And a small number of people derive their income solely from the ownership of capital or natural resources. But for the vast majority of the people in the industrial democracies, "job" and "income" are almost synonymous.

Roger Anderson, a British environmentalist, feels that income distribution is the major social issue raised by automation. To illustrate, he says, " . . . unemployment, far more than falling productivity, is the hallmark of depression. The 1930s are remembered as an era of depression not because total income fell—the average standard of living actually rose—but because of the mass unemployment and resulting maldistribution of income which characterized the period. The economists' classic answer to this problem is to urge further economic growth which is desired not for its own sake but for the employment which it creates."[47]

The conventional way of measuring labor productivity is stood on its ear by the hyper-automation of the electronic age. Already there are a few totally automated assembly lines operating "ghost shifts" in West Germany and Japan. The productivity of the worker who flips the switch to set such a line in motion is indescribably high, by con-

ventional measures. The direct link between a job, productivity and income has been broken, and new ways must be found to distribute not only the material gains, but also the psychic rewards of direct participation in production.

The idea of a guaranteed income is still politically distasteful, even in the more extreme outposts of the welfare state. The most commonly proposed solution to the problem of poverty in capitalist and communist countries alike continues to be a policy of full employment, or a guaranteed job rather than a guaranteed income. The Humphrey-Hawkins Bill, which reasserted the right of every U.S. citizen to a job, passed the U.S. Congress in 1978. China is only now beginning to back away, cautiously, from the "Iron Rice Bowl" guarantee of lifetime employment for any worker no matter how unproductive. China, and perhaps even the Soviet Union, have begun to realize that unconditional guarantees of employment may actually depress productivity growth by removing the incentive for enterprises to use labor more effectively and for workers to improve their skills. But even the communist governments, founded in the spirit of "to each according to his needs," have not circumvented the identification of employment and income. As British trade-unionist Cockroft puts it, "we would rather see people idle on a payroll than busy without pay."[48]

Fortunately, perhaps, we do not have to look forward to a day in the near future when there is little work left for human beings to do—though the *Economist* does assert that by the time today's European, Japanese, and North American youths retire, factory work "will be done more efficiently either by a robot or by cheaper labor in the developing world."[49] The changes brought about by technical and organizational innovation will take time to diffuse. But, gradually, fewer hours of work will be needed to produce wealth. If work is still to be treated as a proxy for income, some thought must be given about how to distribute hours of work.

Labor displacement can be benign if it is distributed among workers as increased voluntary leisure. And if workers are more productive

during their hours on the job, there is no reason why their wages should be reduced in proportion to their hours. This approach, however, is commonly mistrusted both by workers and employers. Workers fear that it is a ploy for reducing the wage bill, and employers suspect that it is a bid for "something for nothing." Nonetheless, many trade unions in the OECD countries have made reduced hours a central part of their efforts to maintain employment.

Shorter work weeks, longer vacation time, and early retirement are characteristic elements of the strategy. In France, the Mitterand Government has embraced the goal of reducing the average work week from 40 to 35 hours by 1985—a move that is expected to create 900,000 new jobs. More than half of the eight million manual laborers represented by British unions have won commitments from industry for work weeks of less than 40 hours. When the Italian textile industry began to automate rapidly in 1975, the affected unions negotiated a six-day, 36-hour week. In West Germany, the metal-working, chemical and construction industries have all acquiesced to union demands for six weeks' annual leave. Other industrial unions are pressing for this concession, as well as for an eventual 35-hour week. Australian trade unions are also campaigning for a 35-hour week, against bitter opposition from both the government and the employers' association. The latter estimated that if reduced hours were introduced throughout industry it would absorb seven years worth of productivity increases at 1981 levels—which may be just what the unions have in mind.[30]

While reduced hours on the job help distribute income by distributing employment, a more creative approach to distribution concentrates on distributing another factor of production: capital. According to author Hazel Henderson, one variant was proposed in the sixties not by a socialist, but by an archcapitalist named Louis Kelso. He pointed out that one answer to the problems caused by the displacement of labor by capital was to turn workers into capitalists by setting up programs that enabled them "to buy a piece of the machine." Employee Stock Ownership Plans (ESOPs) in the United States, which are an outgrowth of his idea, allow employees to buy

shares in their own corporations, for which the companies also receive some tax benefit. The workers derive a second income from their ownership of capital.[51]

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A much more far-reaching scheme of worker ownership has been proposed by LO, the Swedish trade union organization. The plan would tax both wages and profits in order to accumulate funds to buy equity in corporations, the equity to be collectively owned and administered by funds in each of Sweden's 24 provinces. The boards of the funds would be democratically elected, and the profits from the shares would augment public pension funds. At present, the model is closer to rhetoric than reality, but it has contributed to the debate on income distribution and control over the factors of production.[52]

If some way is not found to distribute broadly the gains from higher productivity, the urgently sought increases will not necessarily improve the overall standard of living. If workers displaced by efficiency improvements cannot find other, equally productive work or some other way to maintain their incomes, higher productivity will not increase total output, but will only worsen income distribution. In the process, both the general welfare and the social consensus will be endangered. These dire possibilities, much exaggerated in a period of slow economic growth, cause some observers to turn their back on productivity growth, to insist that no more is needed in the industrial countries, that further growth will actually detract from the quality of life.

It is surely appropriate to call a halt to the old assumptions and ask "productivity for what?" But to call for slower growth is in a way to admit defeat; to concede that we cannot understand productivity well enough even to measure what we really want; to despair of channeling growth into paths that are not destructive either of the natural environment or the human spirit; and to resign ourselves to the supposed insolubility of distribution problems. Surely the creativity and perseverence that produced the "miracles of modern technology" can do better.

Styles of management that give workers greater autonomy and decision-making power on the job have been shown to increase productivity in case after case.

The Productivity Prospect

The course of productivity in the near future will take shape out of an array of conflicting influences. It is by no means certain which of them will dominate—those that would encourage growth in productivity or those that would bring it to a halt and possibly even cause it to decline. Among the negative influences, not all are to be deplored; some of the downward pressure on productivity is the product of necessary adjustments to the new economic realities of this century's final quarter.

New technology will certainly act to raise productivity in those industries where it is applied. Computer-assisted design and manufacturing systems will replace much human labor in the factories of the industrial world, sending the productivity of the remaining workers to unprecedented heights. Much routine paper-shuffling and information processing now done by people will be done by electronic communications systems in the future.

Matching and perhaps even surpassing those "hard" productivity increases brought about by the introduction of new capital equipment will be "soft" increases associated with innovations in the organization and management of work. Styles of management that give workers greater autonomy and decision-making power on the job have been shown to increase productivity in case after case. Many experiments with worker participation in North American and Europe have been initiated in response to the demands of labor unions for more control over the introduction of new technology. Managers on both sides of the Atlantic have also observed that the highly-productive manufacturing sector in Japan has built its competitive power on a foundation of non-adversary labor relations, which give workers a major voice in the organization of tasks and the solution of production problems. Spurred by Japanese competition, many companies have introduced quality circles, groups in which employees discuss ways to improve the production process. Hewlett-Packard, a giant U.S. office equipment and computer firm, had 500 quality circles

40 meeting regularly by mid-1981, and credited a 20 percent improvement in quality to their efforts.[53]

The thrust of quality circles and other forms of worker participation is a greater emphasis on human capital as opposed to physical capital. It is ironic in an age of technological transformation that the most successful companies seem to be those that emphasize the human factor in production. An official of the Japanese Ministry of Trade and Industry explains this element of corporate philosophy in Japan as follows:

> A system in which laborers are replaced like machine parts may be highly effective in the short term. But we are in an age where robots and technology are gradually replacing humans with machines for simple jobs. Productivity will eventually be differentiated by the application of 'subjective' rather than 'objective' technology. It would seem more effective, then, to encourage the development of human resources that are flexible enough to adapt to new technologies. Such flexibility is more likely to place a company in a superior position in the long run.[54]

More participatory forms of organization, if they are widely adopted, can be expected to raise productivity—provided that workers are convinced that they too will benefit from the changes. Experience in the United States has shown that without some form of profit sharing, productivity gains from worker participation may not be sustained.[55]

The example of new managerial styles adopted under pressure of Japanese competition illustrates another influence that may serve to increase productivity in the future: expanding world trade. In the heyday of productivity growth, the 25 years before 1973, world trade grew at a rate of 7 percent per year. In 1981, the growth of trade was at a virtual standstill—as was growth of productivity in most of the major trading countries (Japan excepted). Trade raises productivity in two ways. Competition from abroad forces businesses to pursue increased efficiency as a matter of self-preservation. Furthermore, as less-efficient firms succumb to foreign competition and more efficient ones expand to fill foreign demand, the overall level of productivity in

a country increases. The beneficial effect of trade on productivity is only meaningful, however, if the resources idled by failed industries are quickly redirected to thriving ones. Otherwise, the costs of the adjustment process may overwhelm the benefits of structural change.

In addition to technological change, managerial innovation, and trade, a fourth factor likely to raise productivity in the OECD countries is demographic change. The maturing of the baby boom means that fewer young and inexperienced workers will be entering the labor force in future years. Older, experienced workers are generally more productive workers, and a more mature labor force should experience higher productivity.

Arrayed against these four benign influences are a number of constraints on productivity. They must be separated into two camps: those that are part of the necessary process of adjusting to a new economic context, and those that are unnecessary obstructions to progress. Wiser use of energy, land, and raw materials is a prerequisite for stable, sustainable economic advance, even though it may lower labor productivity. Similarly, greater attention to so-called "externalities"—the unwanted by-products of production such as pollution, occupational injuries and destruction of the environment—is an investment in the quality of life which sometimes must be pursued at the expense of productivity. Industrialists, in complaining bitterly that anti-pollution and health-and-safety measures retard productivity, confuse ends and means. Higher productivity has no intrinsic value; its only value is as a tool for achieving a higher quality of life. To argue that productivity should take precedence over quality of life is to argue, senselessly, that the ends should be sacrificed to the means.

While some negative influences on productivity make positive contributions to the long-term stability of a society, others have little to recommend them beyond political expediency. Protectionism interferes with the productivity-enhancing benefits of world trade in order to make up for deficiencies in the adjustment from less productive to more productive work. In recessionary times, the pressures for pro-

tectionist intervention are intense, but they can be indulged only at the expense of global productivity. "Voluntary" restraints on the export of Japanese cars to Europe and the United States, for example, have effectively idled some of the most productive workers and capital ever seen. Textile quotas have preserved some of the least productive jobs in the manufacturing sectors of the advanced economies, at the expense of eager workers in the Third World for whom a factory job would represent a huge leap in productivity.

The most serious constraint on productivity growth currently is the policy of engineered recession being pursued by leaders of several of the advanced industrial powers. Despite massive tax concessions designed to spur capital investment and thereby raise productivity, most businesses have little incentive to invest during a recession because demand grows slowly or not at all and many businesses are afflicted with overcapacity. Monetarist policies have produced high interest rates that raise the cost of capital investment, at the same time that attempts to reduce spending on social programs retard the development of human capital. Neither course is compatible with high productivity growth.

Policy makers must distinguish between those sources of declining productivity growth that are symptoms of the transition to a sustainable economy and those that serve no constructive purpose. Combining productivity statistics with other indicators is one way to keep the distinction in focus. For example, the amount of energy required to produce a unit of industrial output in the United States fell by 11 percent between 1972 and 1980, according to a report from the Shell Oil Company.[56] The good news on energy productivity helps to balance the bad news on labor productivity. Similarly, productivity trends should not be isolated from employment and income distribution figures. A much-heralded increase in British labor productivity toward the end of 1981 must be seen against the backdrop of unemployment levels that have broken all postwar records. If output had been divided by all hours available for work rather than hours actually worked by those who remained employed, British productivity would have been sharply negative. Productivity gains achieved

through involuntary unemployment represent a hollow victory indeed.

Other imperatives, such as solving the energy crisis or maintaining income distribution, may take priority over raising labor productivity. But this does not mean that raising output per hour worked is unimportant, both as an economic indicator and a long-term goal. If productivity declines or remains stationary, it signals that other fundamental economic problems have not yet been solved.

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